Managing Efforts to Prevent Forest Fires in South America [1]

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Background

South America is divided into 13 countries and has a total population of around 340 million people inhabiting an area covering 17.4 million square kilometres. It has a wide variety of climates, landforms and vegetation, as well as notable differences in this respect within some of the countries themselves. There are similarly wide-ranging economic and social differences with respect to per capita income, access to basic services, infrastructure, education, scientific and technological development and public institutions and civil society.

Table 1—*Basic data for South American countries*

COUNTRY	Land area (km^2)	Population ('000)	Pop. Density (pop/km^2)	Rural pop. (%)	GDP per capita (US$) in 1997
Argentina	2,736,690	36,577	13.4	10.9	8,075
Bolivia	1,084,380	8,142	7.6	36.0	912
Brazil	8,465,510	167,988	19.8	19.3	4,514
Colombia	1,038,710	41,564	40.0	25.5	2,039
Chile	748,810	15,019	20.1	15.5	4,478
Ecuador	276,840	12,411	44.8	38.3	1,531
French Guiana	88,150	174	2.0	22.4	n/a
Guyana	121,498	855	4.4	62.3	766
Paraguay	397,300	5,358	13.5	44.8	1,946
Peru	1,280,000	25,230	19.7	27.6	2,580
Suriname	156,000	415	2.7	48.4	415
Uruguay	174,810	3,313	19.0	8.9	6,076
Venezuela	882,060	23,706	26.9	13.0	3,499
TOTAL	17,450,478	340,752	19.5	20.2	4,329

Source: *FAO (2003), "State of the World's Forests"*

Over fifty percent of the surface area of South America is covered by forest, and it is therefore possible to consider it a forest region. Based on work at the University of Wisconsin's Cartography Laboratory, Mery *(1987)* has established a classification distinguishing six categories of autochthonous vegetation in the region's forests.

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These categories are set out below, together with a generalised indication of their distribution.

1) Tropical forests, this being the predominant type of forest in South America.
2) Pygmy forest, brushland and grasslands on low-lying land, found in varying degrees in most countries in the region, particularly common in Brazil, Paraguay, Ecuador, Bolivia, Chile and Argentina.
3) Tropical savannas, principally found in Brazil, Colombia and Venezuela
4) Mixed Deciduous-Coniferous Forests at medium elevations, principally in Brazil, Argentina and Chile
5) Medium altitude grasslands, which are most common in Brazil, Paraguay, Argentina and Uruguay.
6) Vegetation in arid zones, specifically located in Ecuador, Peru, Chile and Argentina.

Table 2--presents the South American forests and wild areas enjoying protection in 2003 based on reports published by FAO (2003) and PNUMA (2000).

Table 2—*Protected forests and wild areas in South America*

COUNTRY	Total forest (‘000 ha)	Total forest (Pct. of country)	Natural forests (‘000 ha)	Planted forests (‘000 ha)	Wild protected areas (‘000 ha)	Wild protected areas (Pct. of country)
Argentina	34,648	12.7	33,722	926	9,126	3.3
Bolivia	53,068	48.9	53,022	46	17,818	16.4
Brazil	543,905	64.3	538,923	4,982	52,672	6.2
Colombia	49,601	47.8	49,460	141	9,365	9.0
Chile	15,536	20.7	13,396	2,140	14,137	18.9
Ecuador	10,557	38.1	10,390	167	15,552	56.2
French Guiana	7,926	89.9	7,925	1	n/a	n/a
Guyana	16,879	78.5	16,867	12	n/a	n/a
Paraguay	23,372	58.8	23,345	27	1,401	3.5
Peru	65,215	50.9	64,575	640	6,676	5.3
Suriname	14,113	90.5	14,100	13	n/a	n/a
Uruguay	1,292	7.4	630	662	47	0.3
Venezuela	49,506	56.1	48,643	863	56,040	63.5
TOTAL	885,107	50.7	874,472	10,635	209,282	10.7

Sources: UNEP (2000) “GEO – Latin America and the Caribbean”.
FAO (2003) “State of the World’s Forests”.

The GEO report on the future of the environment *(UNEP, 2000)* stated that the most common obstacles were lack of financing, technology, qualified personnel, and, in some cases, the presence of cumbersome and complex legal frameworks, frequently ill-adapted to the realities of the tasks they face. It also drew attention to the three principal environmental issues affecting this region, where state intervention and use of forestry resources is crucial:

- Widespread poverty in rural areas and a progressive population flow into urban areas, principally to mega-cities, where poor air quality is a threat to health and water shortages are an everyday occurrence.
- The depletion and destruction of forests and the threat to biodiversity.
- The impact of climate change, with disasters such as forest fires and floods, causing immeasurable loss to the communities and natural resources.

Although South America could be classified as a forest region due to its high proportion of forest cover, there are only two countries where forestry and timber production play an important role in overall development. In general, forest management has only minimal presence in national economic and social strategies.

The Current State of Protection in South America

Forest fires represent a serious problem in South America, given the way in which they destroy natural renewable resources and their economic, social and environmental impact. This has been confirmed on several occasions at meetings on forest programmes in Latin America organized by the FAO, at which it has been repeatedly emphasized that forest fires and burning constitute significant causes of deforestation and the destruction of forests. However, there have not been any real tangible changes in national policies or in the attitude of the local populations in response to these problems, and therefore their impact has not been reduced.

Forest fires in South America vary tremendously from country to country due to natural variations in climate, vegetation, landforms, land use, education and the behavior of the human population. This results in notable differences in the frequency and extension of fires. If the data is analyzed by country, there are also significant differences within the countries themselves with respect to the size and nature of the problem, and between one season and another.

Furthermore, the management of forest fire prevention and suppression activities also varies greatly in terms of effectiveness and the precise manner in which they are carried out. The distinct economic capacity of each individual country leads to differences in the implementation of forest fire programmes, in awareness of the problems and in the application of efficient technology and organizational frameworks. The national approach to the value and priority of forestry resources and the need to protect them through policy initiatives also has an affect. In addition, traditional land use, which frequently constitutes an insurmountable form of atavism, gives rise to situations which are sometimes incomprehensible, gravely inhibiting the ability of the poorest of countries to take steps which are commonplace elsewhere.

The inherent variability of forest fires and the conditions which make it possible to control them leads to the conclusion that each country should find its own fire

suppression model which adjusts to the principal factors leading to the start and extension of forest fires and to the capacities and limitations in each specific country affecting the establishment of effective prevention and fire fighting systems. The implication is that it is not advisable simply to copy a fire suppression system and to install it in another. Nevertheless, forest fire suppression covers a wide range of specific activities designed to prevent, fight and also use fire, with results which are sometimes worthy of emulation.

The Incidence of Forest Fires

In general, there are serious defects in South American statistics on forest fires. There are exceptional cases of national statistics which are complete and reliable. There are some cases where there are incomplete national records from several sources which do not always agree. On the other hand, practically half the countries concerned do not hold, or do not publish any data on the subject.

An effort has been made to gather statistical data drawing on official reports, various publications and also informal sources in order to gather estimated data on the incidence of forest fires, and the results are presented in Table 3. Argentina, Bolivia and Brazil are conspicuous for the huge surface areas damaged by forest fires, representing around 88% of the total surface area damaged in the six countries studied.

Table 3—***Estimated data on forest fires in South America***

Country	Dates	**Average number of fires** (per year)	Surface area burnt (average ha/year)
Argentina	1990-1999	11,513	1,028,739
Bolivia	1991-2000	N/a	917,400
Brazil	1990-2000	160,000	1,500,000
Colombia	1995-1998	3,246	59,215
Chile	1981-2002	5,251	53,395
Ecuador	N/a	N/a	N/a
French Guiana	N/a	N/a	N/a
Guyana	N/a	N/a	N/a
Paraguay	N/a	N/a	N/a
Peru	N/a	N/a	N/a
Suriname	N/a	N/a	N/a
Uruguay	1990-94	2,353	3,311
Venezuela	1987-99	1,394	8,230

Source: *G. Julio (2003), "Planificación y Prevención de Incendios Forestales en Ecosistemas Nativos-Una Perspectiva de Latinoamérica".*

The six countries concerned suffered an average of 126.96 fires for every 10,000 ha of land per year. If this extrapolated to the other seven countries for which information was unavailable, it can be assumed that there are a total of around 230,000 forest fires a year in South America as a whole. In addition, if it is assumed that these remaining seven countries lose 35 ha of forest per fire, it can be concluded that around 4.8 million ha per year are lost in South America through forest fires. If the direct loss per hectare is valued at US $300, the damage caused by forest fires can be calculated at 1.44 billion dollars per year, without even considering the social and environmental cost arising from the destruction of renewable natural resources and other elements of value on the outskirts of the cities and the villages.

The causes of forest fires

The available information on the origin of forest fires is even more threadbare than the data presented above on the incidence and extension of fires. Table 4 solely provides data on four countries. Unfortunately, the classification criteria are distinct and in certain cases important risk factors such as burning are classified under other headings (negligence, agricultural activities).

Table 4—*Percentage distribution of current estimated causes of forest fires in four South American countries.*

CAUSE	Argentina	Brazil	Chile	Venezuela
Rural activities	-	3	4	30
Burning	-	32	10	9
Recreation and bonfires	-	5	4	-
Cigarettes, etc.	-	10	-	-
Children's toys	-	-	8	-
Railways	-	1	2	-
Movement of people and vehicles	-	-	32	-
Lightening and natural phenomena	10	1	0,3	-
Incendiary	28	41	37	33
Miscellaneous and other acts of negligence	37	7	3	6
Unknown	25	-	-	22

Sources: *G.Julio (2003), "Planificación y Prevención de Incendios Forestales en Ecosistemas Nativos-Una Perspectiva de Latinoamérica".*

R.Vélez (2000), "Los Incendios Forestales en Iberoamérica".

SIF/FUFEF/IPEF (1998), "Anais 1° Seminario Sul-Americano sobre Controle de Incendios Florestais".

Although there are no statistics available to support the claim, the most significant cause of forest fires and the destruction of forests is the use of fire in clearing land for agriculture and livestock. Burning is traditionally carried out without the appropriate control or techniques to secure a positive outcome. Not only does it give rise to situations where the fire spreads out of control, destroying vegetation and valuable property, it also causes the continual degradation of renewable natural resources and the environment, leading to a loss of soil fertility, an increase in erosion, a deterioration of water resources, air and water pollution and, in general, damage to biodiversity and the quality of the human population's living space.

Burning is a complex issue because the rational use of fire involves factors which are beyond the capacity of the farmers. In general, the greatest damage takes place in socially and economically deprived rural areas, with small estate owners, smallholders, communal or indigenous peoples excluded from development and technology, who have the compelling need to survive and who find fire to be their only means of continuing with their traditional use of the land.

The situation is also serious on the large ranches specialising in extensive livestock production, where burning is used to improve grazing due to its ease of use and low cost and because it does not really matter if the fire spreads over large areas, even less so if it causes environmental damage.

In general, the incidence of burning as a percentage of forest fires held steady in the majority of countries. A good example of this problem is Brazil (Table 5), where the percentage of fires caused by burning did not see any reduction over a ten year period.

Table 5—***Changes in patterns of causation in Brazil (percentage of fires over two periods)***

Cause of forest fire	1983 - 87	1994
Forestry activities	6.7	2.7
Burning	33.6	32.2
Cigarettes etc.	8.0	10.2
Recreation	10.9	5.4
Railways	0.9	1.1
Lightening	2.1	1.1
Incendiary	29.8	41.4
Miscellaneous	8.0	5.9

Source: G.Julio (2003), "Planificación y Prevención de Incendios Forestales en Ecosistemas Nativos-Una Perspectiva de Latinoamérica".

One exception to this rule is Chile (Table 6), where burning as a cause of forest fires has dropped over a twenty-five year period from 41.3 % between 1976 and 1980

down to 10-12 % between 1991 and 2000. The factors influencing this change were fire prevention campaigns, intensified legal controls, greater environmental awareness amongst the public and also the decision of the forestry companies to reduce their use of fire in favour of alternative measures.

Table 6—*Changes in patterns of causation in Chile (% of total fires per five year period).*

CAUSE	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000
Burning	41.3	24.0	16.8	10.1	12.4
Forestry work	3.8	3.5	2.9	1.5	2.5
Agricultural work	1.4	2.2	2.1	0.9	1.3
Sport and recreation	4.8	3.5	3.2	2.6	3.1
Children's toys	12.0	8.8	11.1	8.0	6.9
Railways	4.6	3.6	1.9	2.2	1.2
Vehicle transit	2.0	2.0	2.1	1.9	2.1
Human transit	14.2	27.7	31.6	32.5	27.5
Other negligence	1.0	2.5	1.5	1.2	1.3
Incendiary	13.4	20.9	24.9	37.1	39.2
Natural Phenomena	0.1	0.1	0.1	0.3	0.2
Accidents	1.4	1.2	1.8	1.7	1.3
TOTAL FIRES	12,977	24,923	23,774	24,044	22,923

Source: *G.Julio (2003), "Planificación y Prevención de Incendios Forestales en Ecosistemas Nativos-Una Perspectiva de Latinoamérica".*

CONAF: (1976-2001)Anuarios del Sistema Nacional de Estadísticas en Manejo del Fuego

It has also been noted both in Brazil and Chile that there has been a significant increase in the number of intentionally started forest fires. There are several reasons for this particular cause of fires, which is probably to be found over the whole of South America, but they are all basically the product of the increased levels of risk created by the growth of undesirable attitudes amongst the population. Pyromania is experiencing huge growth as a mental illness on the outskirts of large urban areas, the product, it would seem, of development or civilization, and accompanied by a similar growth in suicides and drug addiction and alcoholism.

In addition, Chile, suffers the effects of the introduction of large-scale forest plantations and enormous timber-producing industrial complexes. The benefits of these developments, usually to be found in poverty-stricken rural areas, do not really reach the local inhabitants, and this leads to a state of permanent protest in which the destruction of forests by fire has become one of the weapons used against these huge business empires. This has become one more element in the fight by the indigenous peoples to claim their rights in the lands they believe stolen from them many years ago.

Organization in the control of forest fires

It has already been mentioned that South America is host to a wide variety of climates, land forms and renewable resource, as well as natural environments and ecosystems in general. There are also highly heterogeneous levels of economic,

social and cultural development. This creates differences in the nature of the problems which give rise to fires and their spread into forest fires, as well as varying capacity, criteria and methods applied in the suppression of fires.

Although there is usually an awareness of the damage caused by forest fires, it is noticeable that there is an insufficiently clear notion of how the problem is to be tackled, which is related to a certain extent to the lack of political will to promote effective forest protection. The following comments can be made in this respect:

a) Responsibility for forest protection generally falls upon government agencies. However, although forests are a prime natural resource, the sector appears to be ill-defined or low in the priorities of the state apparatus. In general, forestry activities are considered to be an extension of agriculture, which places a heavy limitation on the depth of analysis and evaluation required to formulate proposals for the sector's development.

b) This means that the alarm and damage caused by forest fires leaves governments turning to a wide range of institutions with only a partial capacity to address the problem, such as firefighters, the military and police, etc. These organizations do not normally have the degree of specialization or adequate equipment to fight fires in rural areas, and their efforts are often inefficient. The experiences of the developed countries indicate that the most effective method of combating forest fires is the use of professional bodies which specialize in this specific task.

c) In any event, fire management is much more than firefighting, given that it covers a wide range of activities which must be undertaken simultaneously and in a co-coordinated fashion. Aspects such as prevention, fire detection and even the manner, in which the firefighting forces themselves are organized, must all be placed within the same overall framework in order to plan and develop successful fire management programmes. In the current situation, when the above-mentioned activities are put under the control of several different bodies, there is a noted tendency for each body to approach their responsibilities with differing criteria and degrees of preparation, and they frequently compete amongst themselves rather than reinforce their efforts through co-operation and synergies.

d) The lack of reliable data makes it difficult to analyze the difficulties and obstructs appropriate planning of prevention and firefighting activities. It is not possible to develop appropriate policy initiatives or the necessary strategies without sufficient knowledge of the nature and degree of the damage being done or of the available resources to put the control measures into effect.

e) Some countries frequently draw on foreign organizations to evaluate the problem of forest fires, and to obtain proposals for action. The consultants generally take their work seriously and duly provide their recommendations. However, the situation nearly always returns to the point of departure once the experts have taken the plane home, and the reasons might be found in the following comments:

    i. The government which receives the international input is often institutionally incapable of carrying the consultant's work forward. Perhaps, the most serious flaw however, is the failure to assign adequate resources to the expert report to permit the joint participation of local officials in the analysis of the existing problems

and in the generation of proposals to ensure that the project begun by the outside experts may be taken further in the future.

ii. In addition, the consultants offer their own personal views, based on experience which does not always include a sufficient understanding of the nature and conditions of the country concerned. Furthermore, when the experts come from a more developed country in the other hemisphere, the tendency is for them to propose solutions which are much better suited to their home countries than the country seeking advice, where the solutions are almost impossible to put into action. The consultants are not really in the country long enough (normally only a couple of months) to build up an accurate picture of the situation and circumstances which should form the basis of their recommendations.

FINAL COMMENTS

The information provided above indicates that South American countries are being seriously affected by the number and extent of forest fires and also that the majority of governments have not yet established effective means of protecting their renewable natural resources.

It is thought that there are no significant technical barriers in any of the South American countries to the design and implementation of a proprietary system for the control of forest fires based on the specific conditions and resources available in each individual country. However, this can only be achieved if the relevant bodies take their responsibility for the protection of forests seriously. Once the specialists with links to the problem, particularly those involved in forestry activities, are transformed from passive spectators to active agents of change, much of the groundwork will have been laid to achieve the level of organization required to control forest fires.

It should not be forgotten that although foreign experience can be extremely helpful in this task, a significant proportion of each individual country's circumstances are unique and different from those of their neighbours. This suggests that the initiative, creativity and determination to confront the problem should principally be drawn from those who are directly affected by the problem.

It is essential that steps are taken to set up effective training programmes for all officials involved in this issue, at all levels of the organizations concerned. It is not only the organizations' workforces which need to be adequately trained in order to carry out their duties in the prevention, suppression and use of fire, but also the senior managers, who need to have a global understanding of the problem and to be aware of the capabilities of the available fire protection resources, as well as the general and specific criteria and strategies which are applicable to fire prevention. It must be stressed that the principal barrier in these countries is not the lack of funds (although money is, in general, in short supply), but rather in the manner in which they are allocated and used.

Some of these countries have managed to incorporate obligatory modules on forest fire prevention into courses for forestry specialists at technical colleges and universities. These are the very same countries which enjoy the highest levels of prevention and firefighting capability. This policy should be generally applied,

because experience has shown that the professionals produced by these schools are the most able to pass knowledge on to the workforce, while at the same time they also lay the foundations for policy creation and planning in this respect within the general context of the management of sustainable forest resources, given their greater capacity to set out the arguments and persuade the authorities of the need to establish organisational frameworks which are technically sound and capable of implementation.

BIBLIOGRAPHY

BAPTISTA, P. (1998) Los Incendios Forestales en la República Oriental de Uruguay. Anais 1° Seminario Sul Americano sobre Controle de Incendios Florestais. SIF/FUPEF/IPEF, Belo Horizonte, Brazil. pp. 332–345.

CORNACCHIA, G., Pereira de Sá, S. (1998) Sistema Nacional de Prevencao e Combate aos Incendios Florestais-Prevfogo-Metas e Resultados 1995-97. Anais 1° Seminario Sul Americano sobre Controle de Incendios Florestais. SIF/FUPEF/IPEF, Belo Horizonte, Brazil. pp. 21–31.

FAO (2003). Situación de los Bosques en el Mundo. Departamento de Montes, FAO, Roma. 151 p.

HEREDIA, R. (1999) Plan Nacional de Manejo del Fuego: República Argentina. FAO Meeting on Public Policies Affecting Forest Fires. FAO Forestry Paper 138. Rome. pp. 307–311.

IFFN (2003) Fire Situation in Argentina. Country Notes, IFFN No. 28. pp 37–40.

IFFN (2003) Fire Situation in Bolivia. Country Notes, IFFN No. 28. pp 41–44.

IFFN (2003) Fire Situation in Brazil. Country Notes, IFFN No. 28. pp 45–50.

IFFN (2003) Fire Situation in Colombia. Country Notes, IFFN No. 28. pp 67–72.

JULIO, G. (1996) Control de Incendios Forestales en Chile: Participación del Gobierno y Empresas Privadas. Anais IV Reuniao Tecnica Conjunta FUPEF/SIF/IPEF em Controle de Incendios Florestais. Curitiba, Brazil. pp. 29–39.

JULIO, G. (2001) Estado Actual y Perspecticas de la Protección contra Incendios Forestales en América Latina. Actas 1° Simposium Nacioal sobre Técnicas de los Medios Aéreos en Incendios Forestales. Universidad de Córdoba/ENRESA/Junta de Andalucía. Córdoba. pp. 137–148.

JULIO, G. (2003) Planificación y Prevención de Incendios Forestales en Ecosistemas Nativos-Una Perspectiva Latinoamericana. VI Maestría en Conservación del Medio Natural. Universidad Internacional de Anadalucía, La Rábida, Spain. 14 p.

MENDES RAMOS, P. (1999) Public Policies Affecting Forest Fires in Brazil. FAO Meeting on Public Policies Affecting Forest Fires. FAO Forestry Paper 138. Rome. pp. 313–317.

MERY, G. (1987) "Latin America Forest Sector Development: A Short-Term Review and Prospects". In: Deforestation or Development in the Third World? - Volume I. Division of Social Economics of Forestry, Finnish Forest Research Institute, Pub.Nr 272, Helsinki. pp. 143–219.

MUTCH,R., LEE,B., PERKINS,J. (1999) Public Policies Affecting Forest Fires in the Americas an the Caribbean. FAO Meeting on Public Policies Affecting Forest Fires. FAO Forestry Paper 138. Rome. pp. 65–107.

PNUMA. (2000) GEO – América Latina y El Caribe. Perspectivas del Medio Ambiente. Oficina Regional del PNUMA, Mexico City, 144 p.

TESOLIN, O. (1999) Políticas Públicas que afectan los Incendios Forestales en Argentina. FAO Meeting on Public Policies Affecting Forest Fires. FAO Forestry Paper 138. Roma. pp. 303–305.

VELEZ, R. (2000) La Defensa contra Incendios Forestales – Fundamentos y Experiencias. McGraw Hill-Interamericana de España, Madrid. 1302 p. (14)

YEGRES, L.E. (1998) Control de Incendios Forestales en Venezuela. Anais 1° Seminario Sul Americano sobre Controle de Incendios Florestais. SIF/FUPEF/IPEF, Belo Horizonte, Brazil. pp. 13–19.

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